Hydrological summary

for the United Kingdom

May 2000

General

The very episodic weather patterns, which have typified the year thus far, continued in May. Relatively dry in much of northern Britain but exceptionally wet in parts of the South after a dry start. Especially unsettled conditions over the final week triggered widespread, but mostly minor, flood events and, very unusually, left many eastern catchments vulnerable to further early summer flooding. Reservoir levels declined significantly in most northern reservoirs but remained steady in the south; overall stocks for England and Wales are the highest on record for early June. The exceptional April/May rainfall totals have reversed the seasonal decline in lowland groundwater levels which now stand well above average in most areas. With very substantial spring-flow contributions to lowland river flows, the general resources outlook for the summer is very healthy.

Rainfall

High pressure dominated weather patterns in early May producing lengthy runs of rainless days over wide areas, although the warm, humid conditions triggered damaging thunderstorms in some localities. On the 7th a remarkable 65 mm storm of rain and hail was recorded in less than two hours in Bracknell, overwhelming the drainage network and generating significant flooding. Severe but very localised flooding featured along the south coast from Cornwall to Hants on the 10th. Over the Bank Holiday weekend, frontal rainfall produced large areal totals over much of the south and east (many catchments registering > 20 mm on the 27th). Rainfall totals for May showed a reversal of the normal rainfall gradient across the UK – monthly totals for much of the South-East exceeded those for the Scottish Highlands. Scotland registered its driest month since May 1998 with much of central and western Scotland, including parts of Northern Ireland , reporting <60% of average. By contrast, most of the English lowlands exceeded 150%. Many eastern catchments recorded more than twice the May average - for the second successive month in parts of the South-East. However, the thundery nature of much of the rainfall did make for large spatial variability. For England and Wales, the combined April/May rainfall was the third highest since 1843 and unprecedented for the Thames catchment in a series from 1883. Spring (March-May) rainfall totals were modestly below average in Northern Ireland and parts of Scotland, but well above average in the South.

River flows

May was notable for the very wide range of flows experienced through the month. The spates of late April gave way to sustained recessions, producing low flows around the third week – particularly in rivers draining the Scottish Highlands. Steep recoveries followed, especially in eastern and southern catchments. The isolated flooding associated with convectional storms early in the month was followed by widespread spate conditions over the 27-29th – triggering a substantial number of mostly minor flood alerts. May runoff totals were widely eclipsed in the English lowlands, particularly notable in permeable catchments where flows were boosted by the lagged impact of heavy April groundwater recharge. The Kennet, Coln, Test, Itchen, Avon and Piddle, all with records of >35 years, were among such rivers. By contrast, below average flows typified many rivers in northern England and much of Northern Ireland. For May, mean flows in the Tay ranked fourth lowest in a 48-year record and the River Ewe recorded its second lowest mean flow in a series from 1970. Spring runoff totals were modestly below average in much of northern Britain but amongst the highest on record in parts of the English lowlands. Runoff accumulations for the year thus far are mostly healthy but scattered exceptions occur. In the south east of Northern Ireland the depressed runoff in the Annacloy river is reflected in the low stocks for the Silent Valley reservoirs.

Groundwater

May rainfall, concentrated towards the end of the month when substantial soil moisture deficits had become established, generally meant that infiltration, though well above average, was still modest in most of the outcrop areas of the major lowland aquifers. Nonetheless, in combination with the very heavy April recharge, this seasonally late surge of replenishment produced rising groundwater levels in May/early June, counter to the normal seasonal trend. Consequently, late-May groundwater levels were above to well above average in most lowland areas – a circumstance which appeared very unlikely in late March. One exception is the deep groundwater in the slowly responding eastern Chalk (represented by the Therfield well) where levels have been below average since the drought of 1995-97. Levels in limestone aquifers are generally above average, well above average in most western and central boreholes in the Permo-Triassic sandstones (but levels remain low at Redbank and the unresponsive Morris Dancers), and notably so in the Magnesian Limestone wells. The Essex gravels showed significant rises, although levels in other drift aquifers in East Anglia were modest.

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Rainfall accumulations and return period estimates

Area	Rainfall	May 2000	Apr 00-May 00	RP	Mar 00-May 00	RP	Dec 99-May 00	RP	Jun 99-May 00	RP
England & Wales	mm	82	209		243		528		997	
	%	128	169	40-60	124	5-10	120	5-10	111	5-10
North West	mm	74	186		246		692		1259	
	%	99	127	5-10	102	2-5	123	5-10	105	2-5
Northumbrian	mm	60	193		232		501		910	
	%	97	164	20-35	124	5-10	122	5-10	107	2-5
Severn Trent	mm	74	204		229		447		874	
	%	125	179	40-60	131	5-10	119	5-10	116	5-10
Yorkshire	mm	62	214		243		458		848	
	%	103	180	40-60	130	5-10	112	2-5	103	2-5
Anglian	mm	87	184		202		342		708	
	%	182	196	110-150	143	10-20	121	5-10	119	5-15
Thames	mm	91	222		238		434		830	
	%	162	209	120-170	147	10-20	127	5-10	120	5-15
Southern	mm	101	239		262		500		907	
	%	187	223	>200	154	20-30	129	10-15	116	5-10
Wessex	mm	84	237		271		554		999	
	%	137	207	120-170	147	10-20	129	5-15	119	5-10
South West	mm	98	239		276		707		1205	
	%	136	169	20-35	115	2-5	114	2-5	103	2-5
Welsh	mm	96	243		306		804		1488	
	%	117	150	10-20	114	2-5	121	5-10	113	5-10
Scotland	mm	62	163		280		927		1660	
	%	72	101	2-5	98	2-5	134	50-80	116	10-20
Highland	mm	68	180		357		1240		2137	
	%	74	99	2-5	104	2-5	145	>200	121	25-40
North East	mm	72	220		278		619		1128	
	%	105	171	60-90	134	10-15	133	25-40	116	5-15
Tay	mm	61	167		253		811		1422	
	%	73	115	2-5	99	2-5	131	10-20	116	5-10
Forth	mm	53	158		238		721		1272	
	%	71	119	2-5	105	2-5	135	30-45	115	5-10
Tweed	mm	56	178		233		576		1030	
	%	78	139	5-10	112	2-5	123	5-10	106	2-5
Solway	mm	72	163		261		858		1541	
	%	85	101	2-5	94	2-5	125	10-15	108	2-5
Clyde	mm	59	138		274		1084		1919	
	%	64	79	2-5	85	2-5	134	30-45	113	5-10
Northern Ireland	mm	58	157		214		603		1161	
	%	82	116	2-5	96	2-5	117	5-10	110	2-5

RP = Return period

 All monthly totals since July 1998 are provisional (see page 12). Recent monthly rainfall figures for the Scottish regions have been compiled using data provided by the Scottish Environment Protection Agency. The return period estimates are based on tables provided by the Meteorological Office (see Tabony, R.C., 1977, *The variability of long duration rainfall over Great Britain*, Scientific Paper No. 37) and relate to the specified span of months only (return periods may be up to an order of magnitude less if n-month periods beginning in any month are considered); RP estimates for Northern Ireland are based on the tables for north-west England. The tables reflect rainfall over the period 1911-70 and assume a stable climate. Artifacts in the England & Wales and Scotland rainfall series can exaggerate the relative wetness of the recent past. *See page 12.

Key

00% Percentage of 1961-90 average

Very wet

Substantially above average

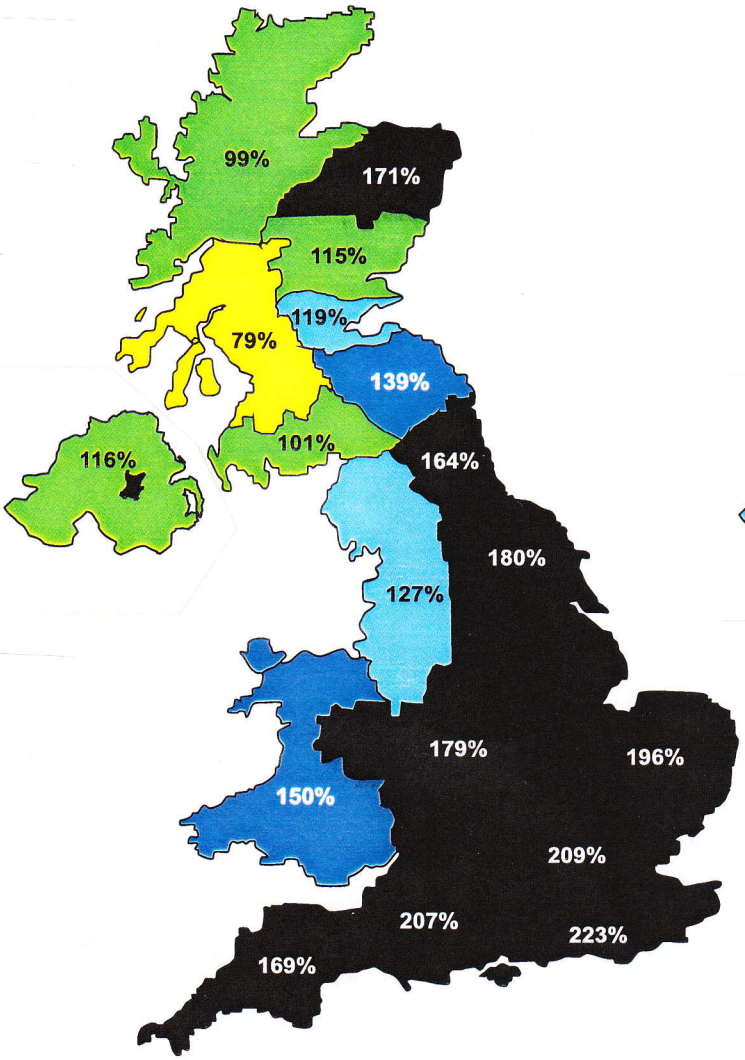
Above average

Normal range

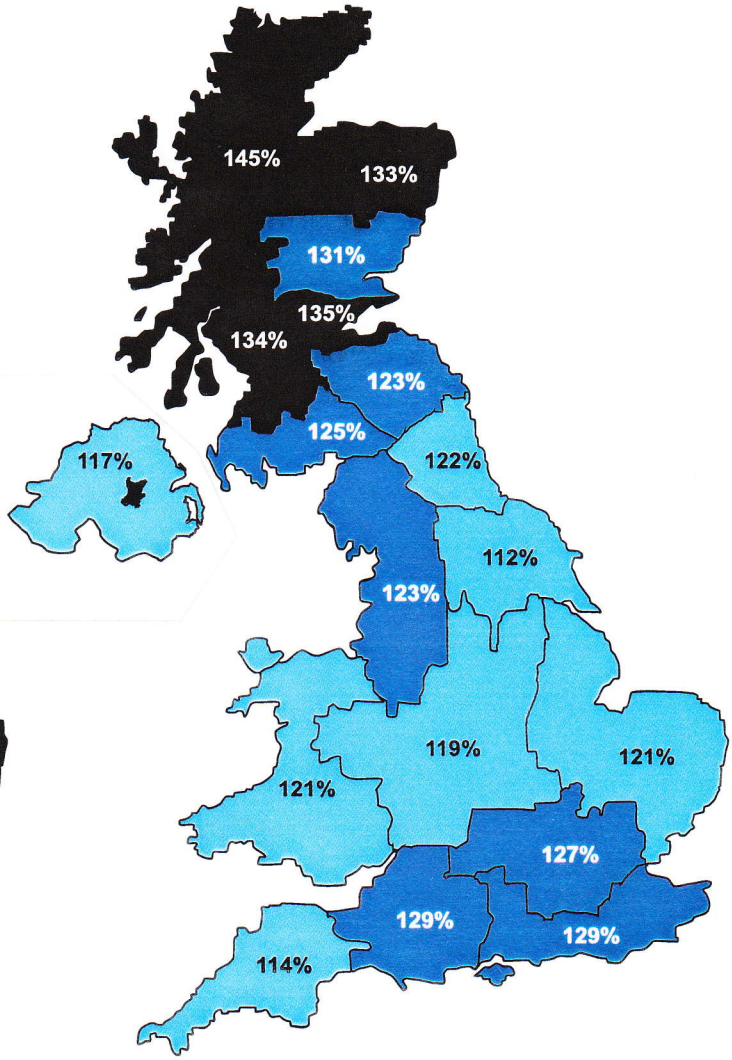
Below average

Substantially below average

Exceptionally low rainfall



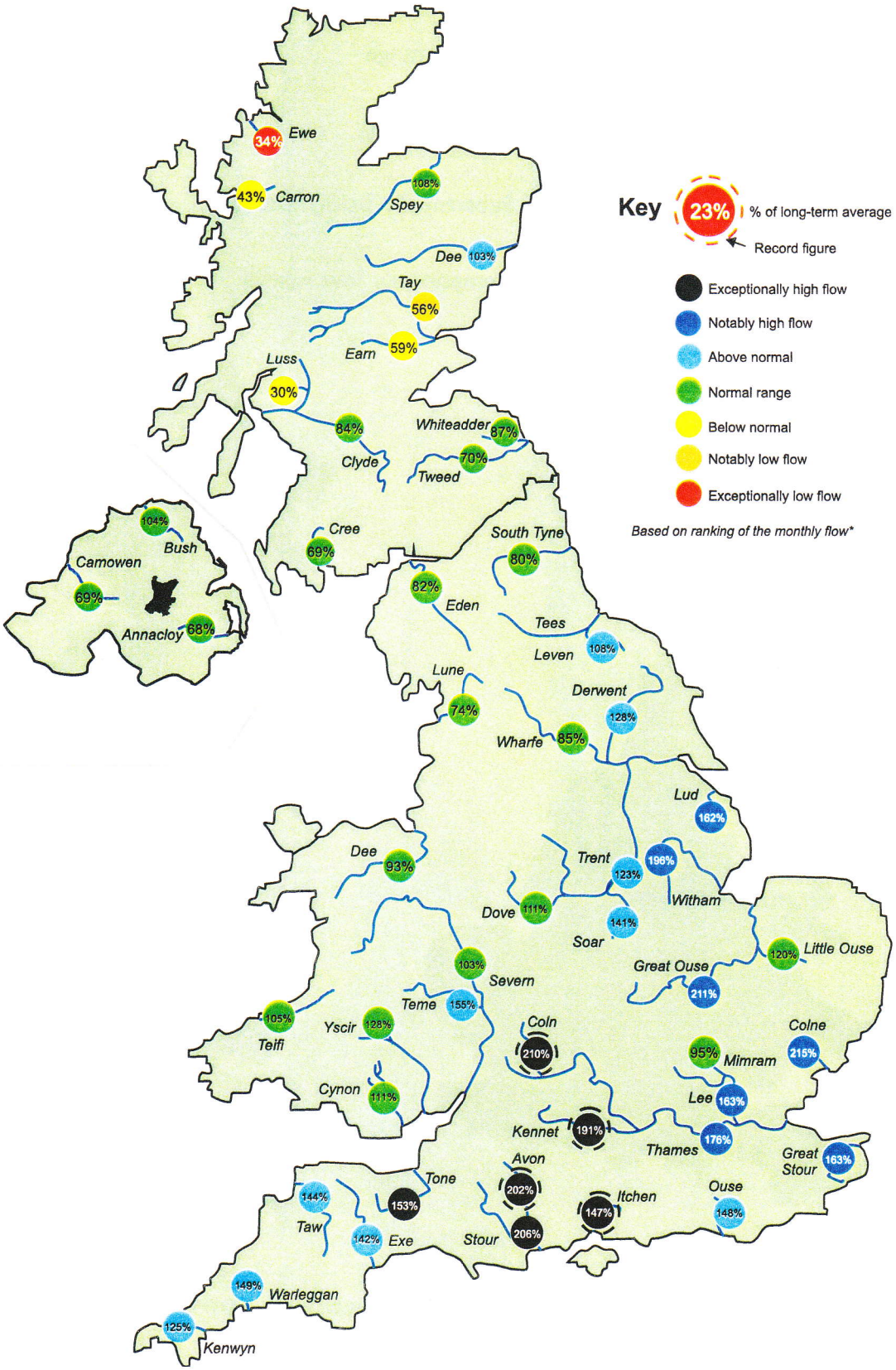
April 2000 - May 2000



December 1999 - May 2000

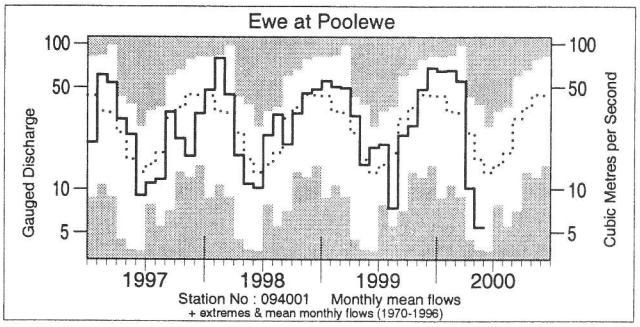
Rainfall accumulation maps

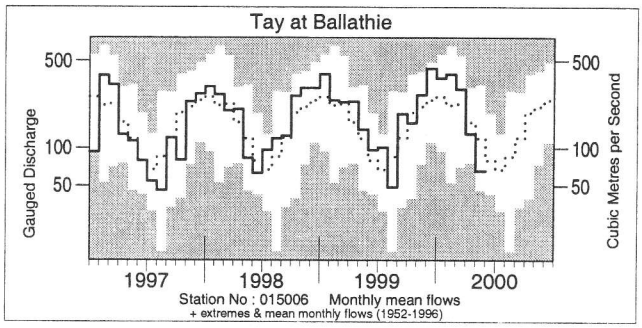
The notably wet late spring has emphasised the healthy water resources outlook (in all but a few areas). In the December - May timeframe, the provisional UK rainfall total for 1999/2000 ranks equal sixth wettest in a series from 1900, but 1989/90, 1993/94 and 1994/95 all registered higher six-month rainfall totals. Once again - and despite the relatively dry May - the combined winter and spring rainfall total (1999/2000) for Scotland was exceptionally high.

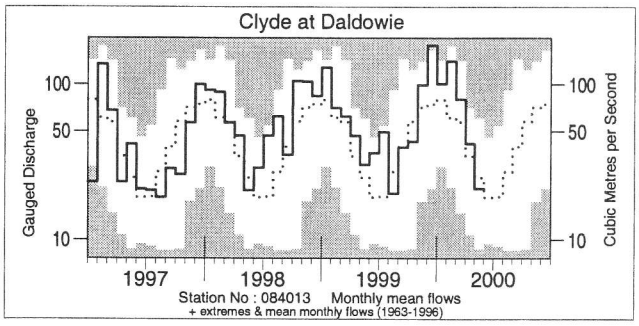


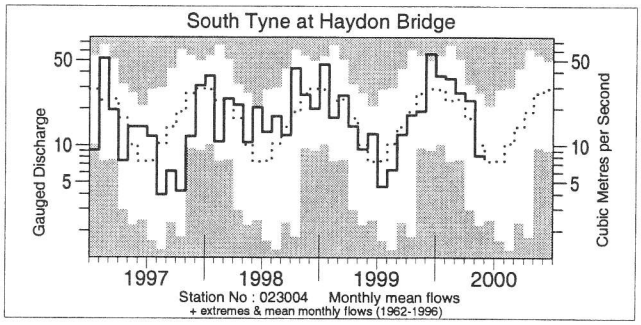
River flows - May 2000

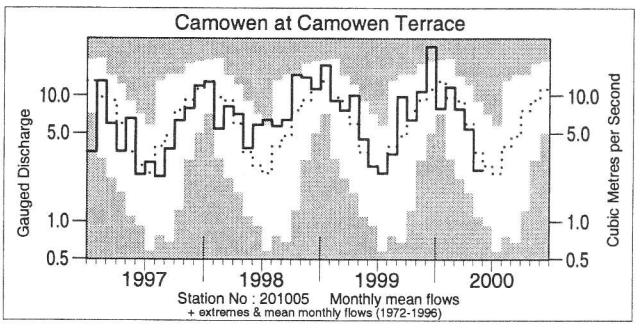
*Comparisons based on percentage flows alone can be misleading. A given percentage flow can represent extreme drought conditions in permeable catchments where flow patterns are relatively stable but be well within the normal range in impermeable catchments where the natural variation in flows is much greater. Note: the period of record on which these percentages are based varies from station to station.

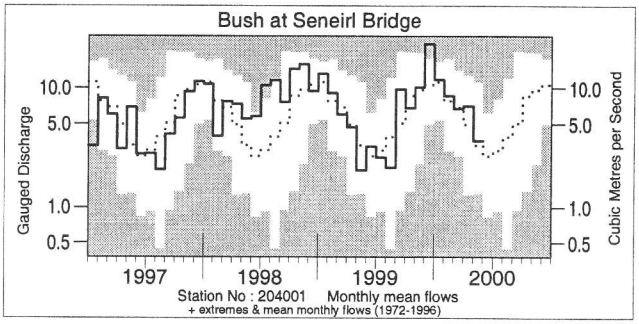


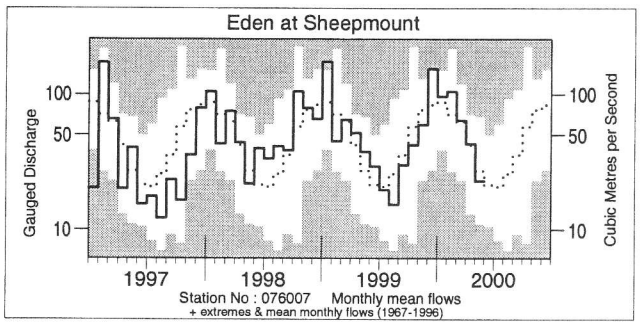


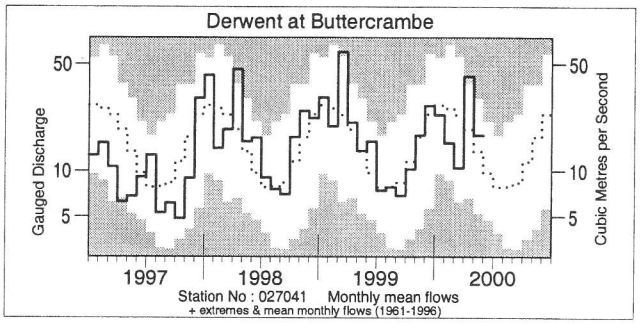


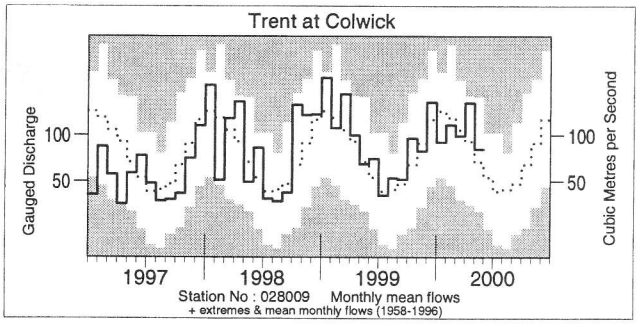


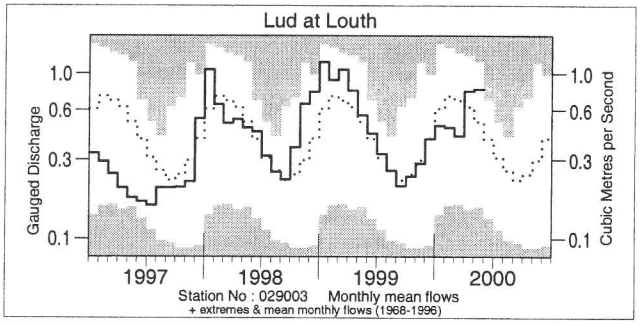








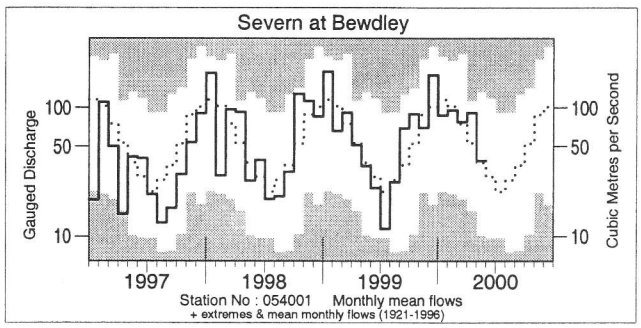


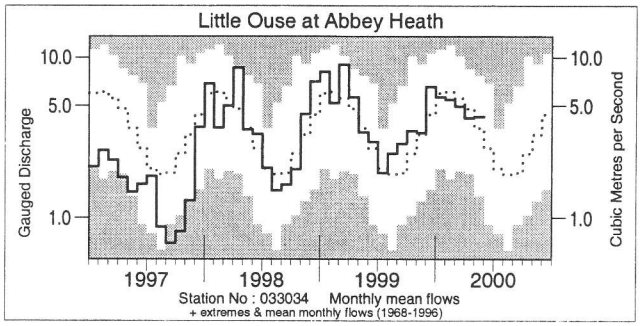


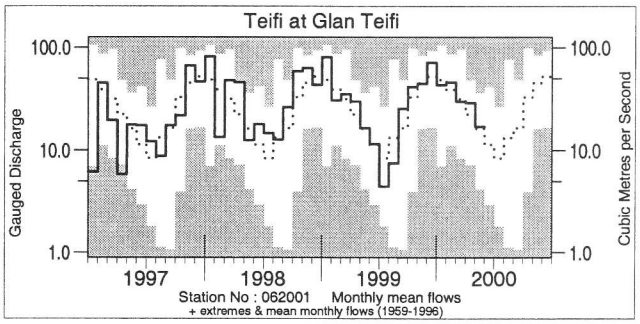
Monthly river flow hydrographs

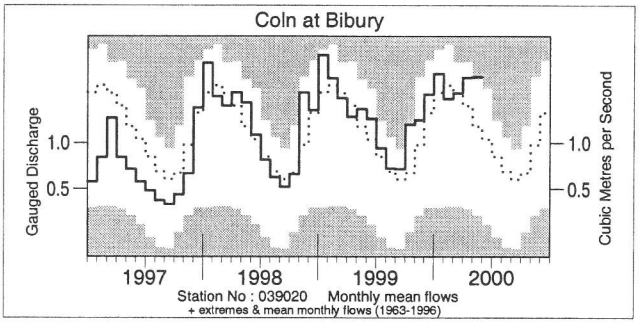
The river flow hydrographs show the monthly mean flow (bold trace), the long term average monthly flow (dotted trace) and the maximum and minimum flow prior to 1997 (shown by the shaded areas). Monthly flows falling outside the maximum/minimum range are indicated where the bold trace enters the shaded areas.

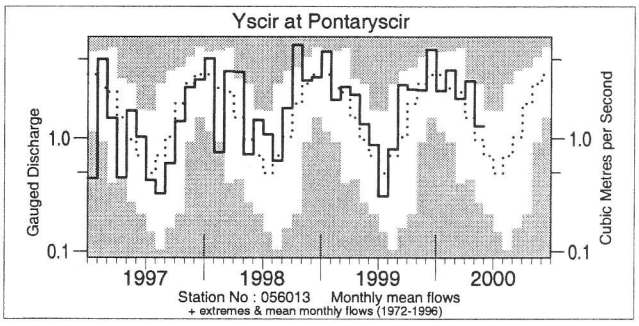
River flow . . . River flow . . .

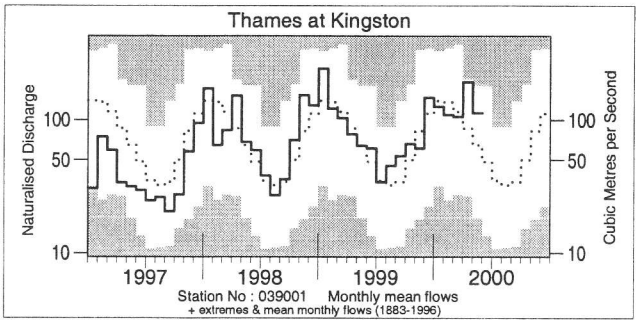


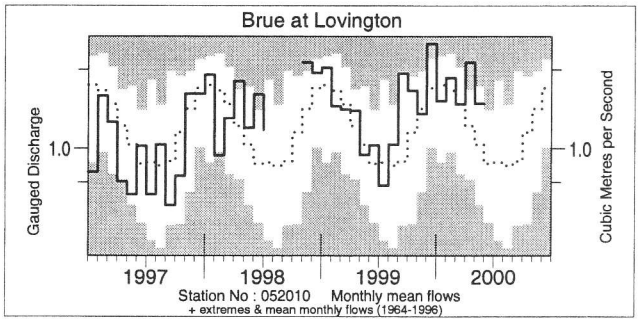


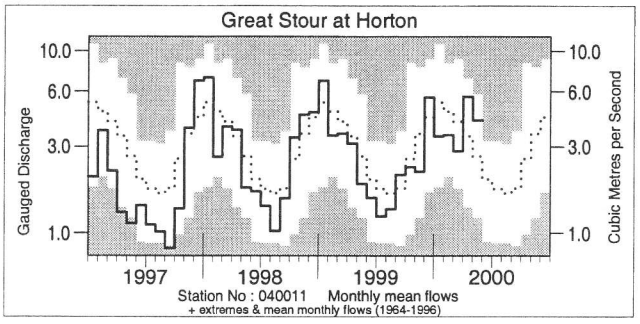


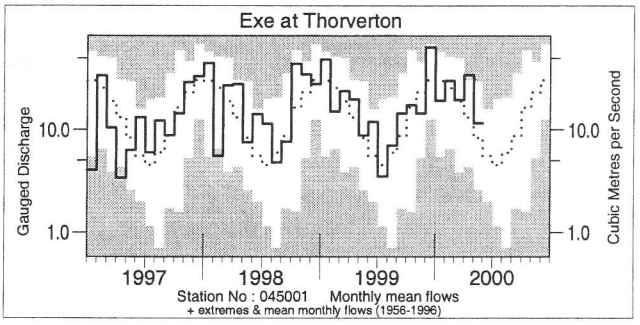


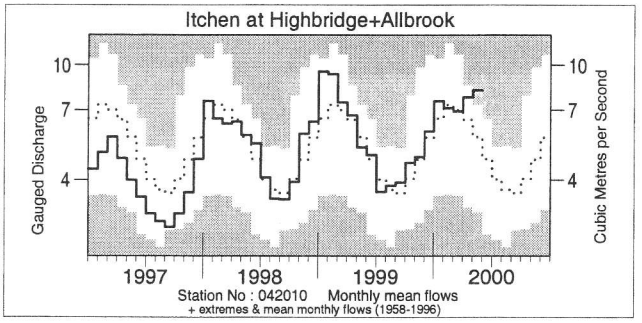












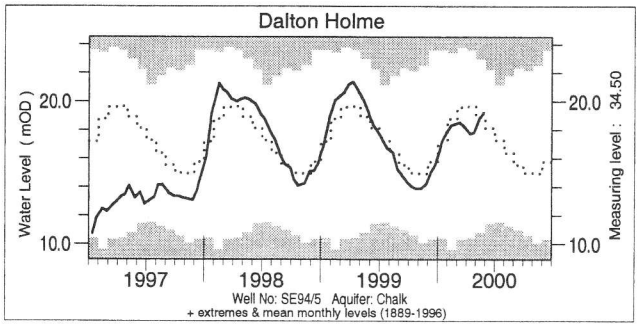
Notable runoff accumulations March - May 2000 (a); December 1999 - May 2000 (b)

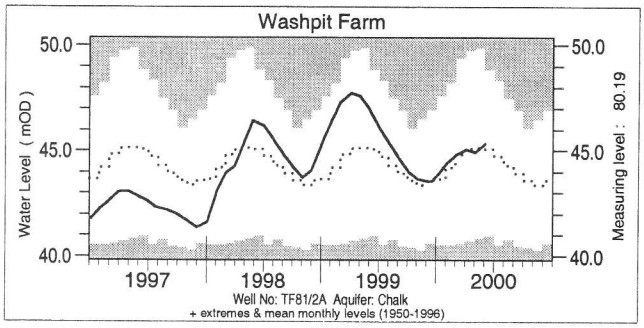
(a) River	%lta	Rank	River	%lta	Rank
Ouse	176	60/68	Mole	172	26/26
Thames	154	110/118	Exe	156	42/44
Blackwater	171	47/48	Luss	62	2/24
Kennet	147	39/39	Annacloy	69	4/21

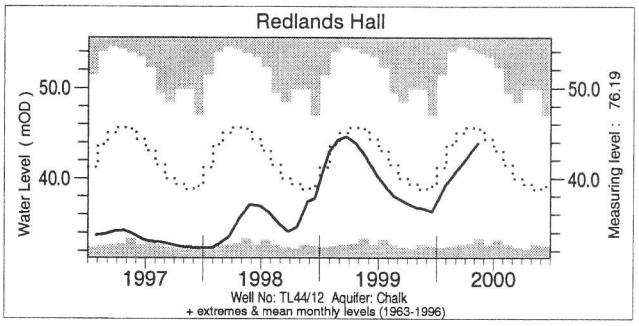
(b) River	%lta	Rank
Brue	168	36/36
Clyde	164	37/37
Spey	151	48/48
Annacloy	81	2/20

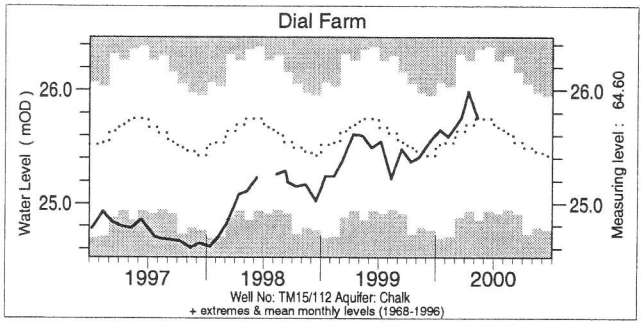
lta = long term average
Rank 1 = lowest on record

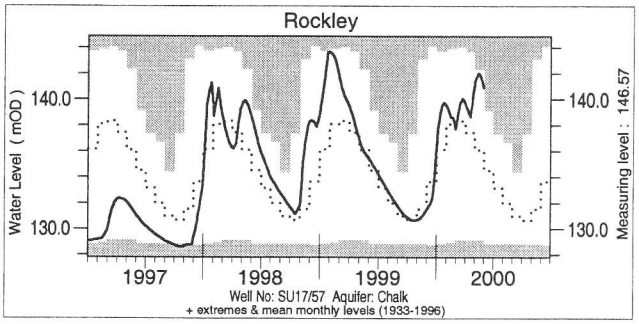
Groundwater . . . Groundwater

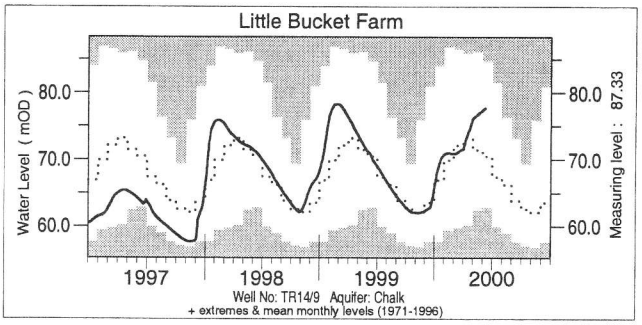


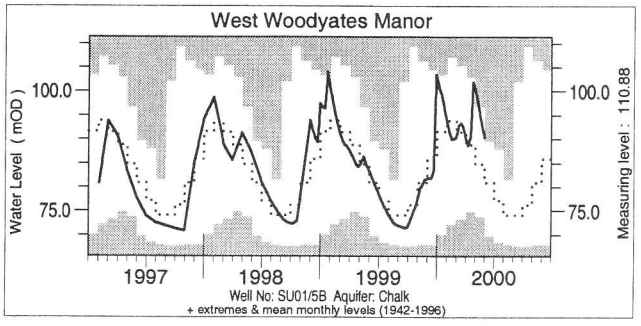


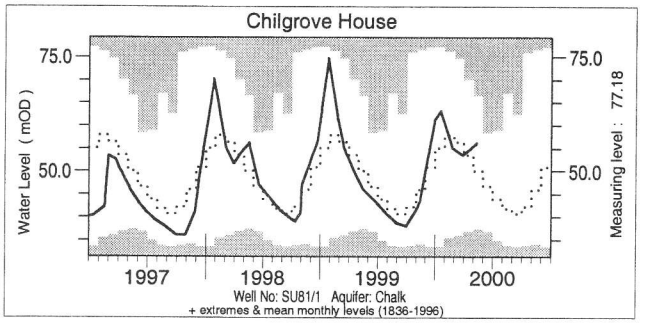


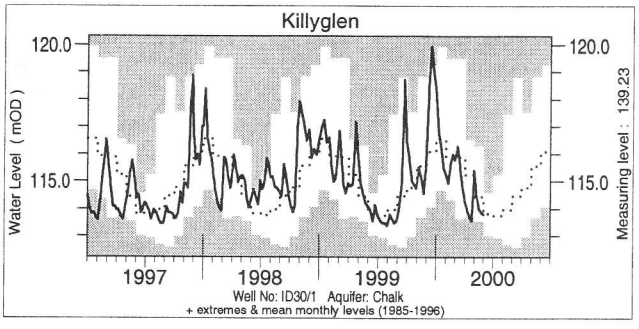


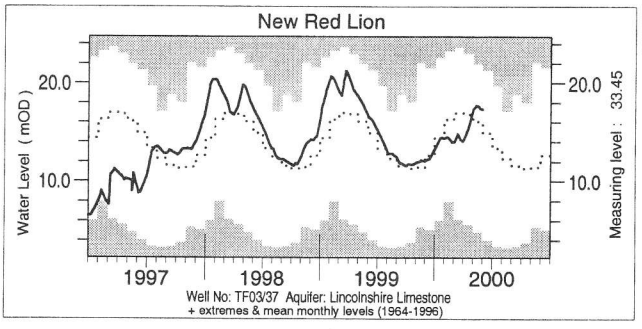








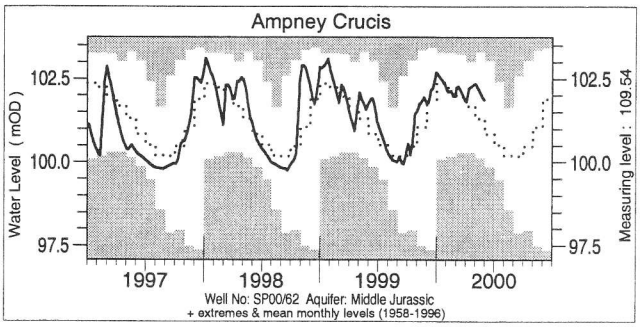


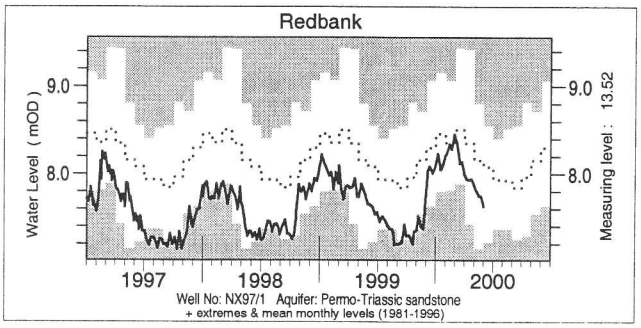


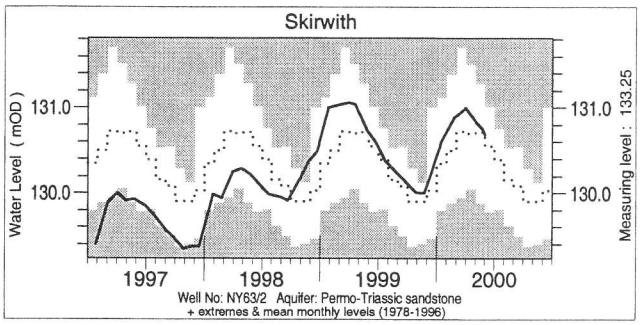
What is groundwater?

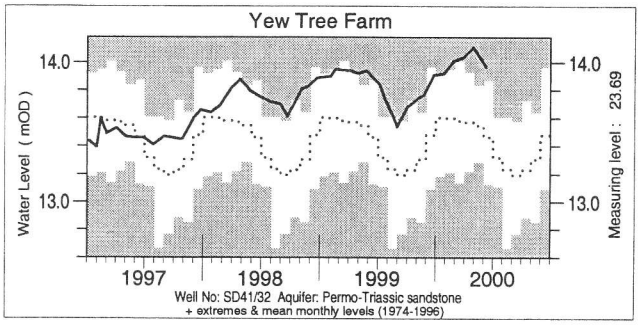
Groundwater is stored in the natural water bearing rock strata (or aquifers) which are found mostly in southern and eastern England (see page 11) where groundwater is the major water supply source. Groundwater levels normally rise and fall with the seasons, reaching a peak in the spring following replenishment through the winter (when evaporation losses are low and soil moist). They decline through the summer and early autumn. This seasonal variation is much reduced when the aquifer is confined below overlying impermeable strata. The monthly max., min. and mean levels are displayed in a similar style to the river flow hydrographs, note that most groundwater levels are not measured continuously — the latest recorded levels are listed overleaf.

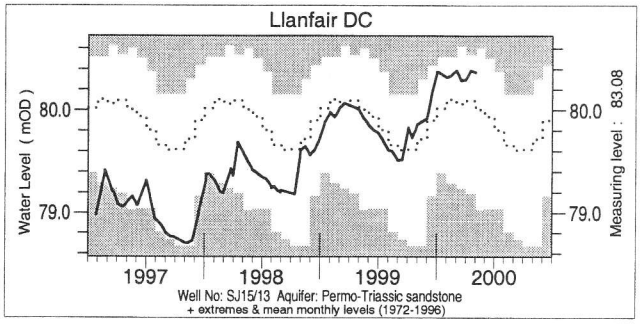
Groundwater . . . Groundwater

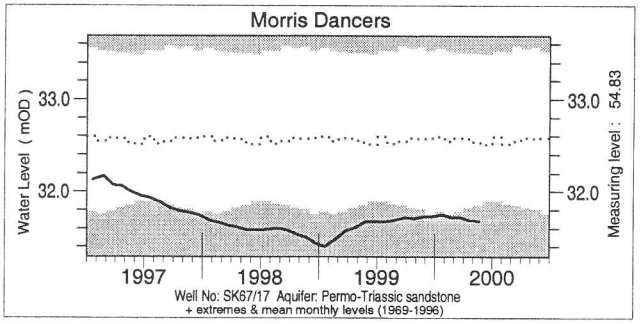


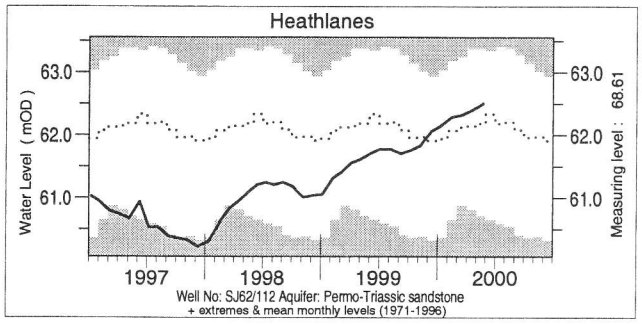


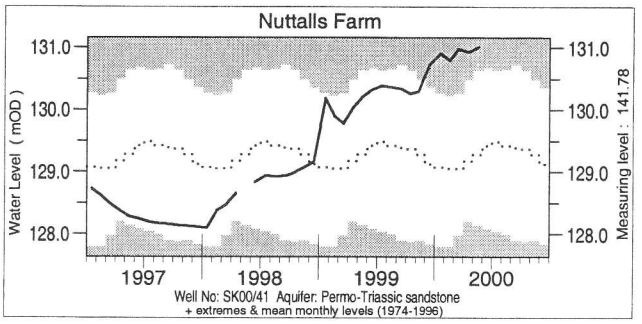


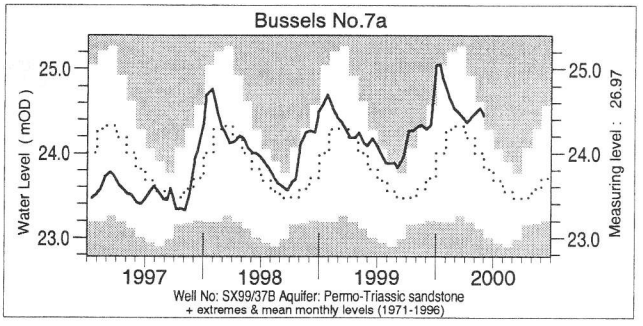


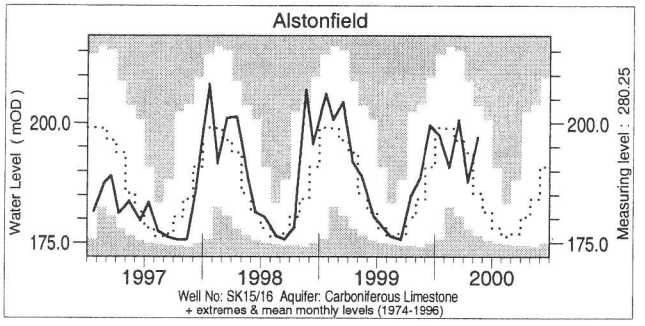












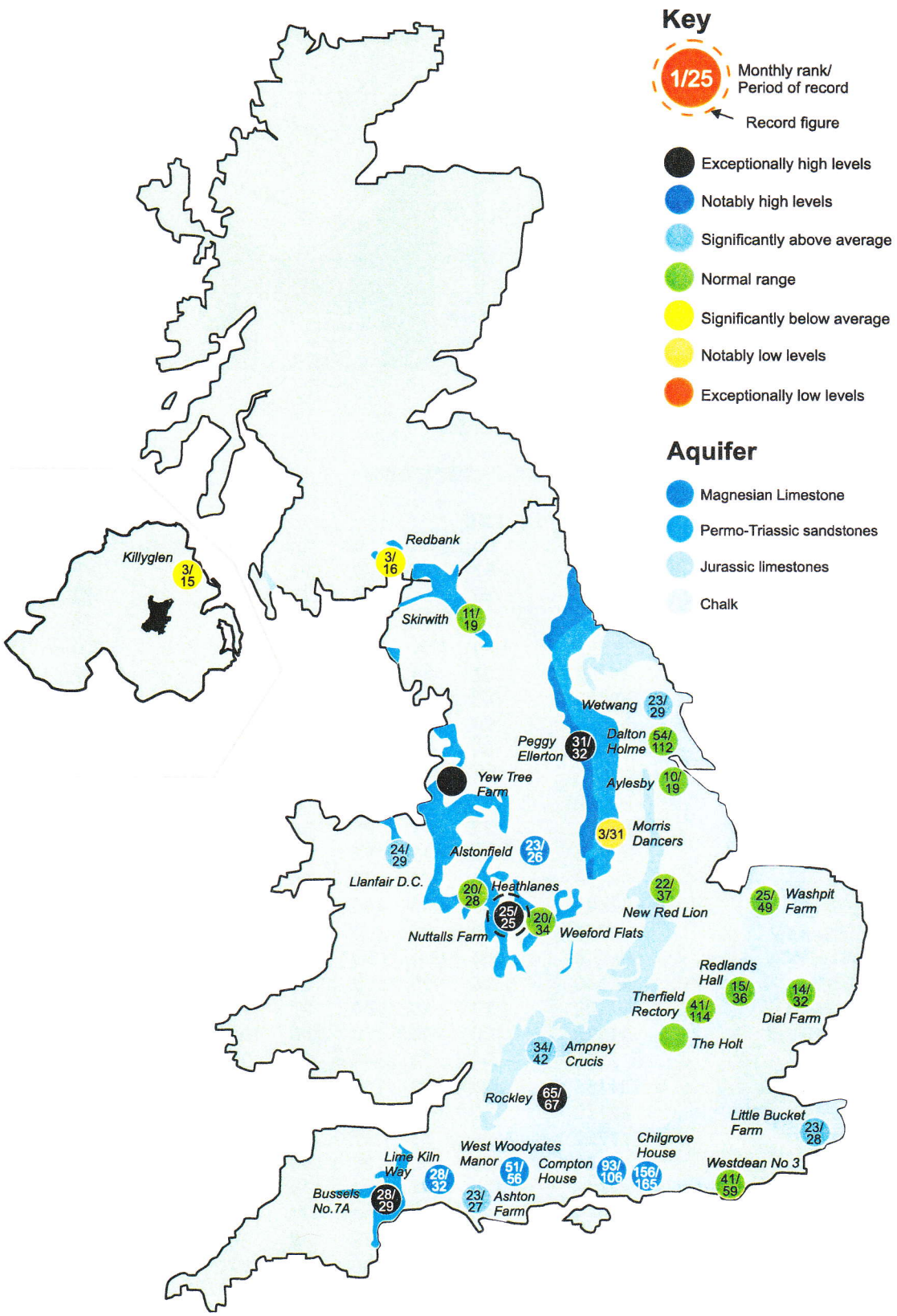
Groundwater levels May/June 2000

Borehole	Level	Date	May av.
Dalton Holme	19.22	26/05	18.93
Washpit Farm	45.33	02/06	45.28
Redlands Hall	43.92	11/05	44.43
Dial Farm	25.75	11/05	25.70
Rockley	140.93	29/05	136.08
Little Bucket	77.71	08/06	72.02
West Woodyates	90.24	31/05	84.40

Borehole	Level	Date	May av.
Chilgrove	56.20	12/05	48.93
Killyglen	113.80	31/05	114.55
New Red Lion	17.33	01/06	15.89
Ampney Crucis	101.87	29/05	101.24
Redbank	7.63	31/05	8.12
Skirwith	130.69	31/05	130.57
Yew Tree Farm	13.97	07/06	13.57

Borehole	Level	Date	May av.
Llanfair D.C.	80.20	01/06	79.88
Morris Dancers	31.68	22/05	32.43
Heathlanes	62.51	24/05	62.08
Nuttalls Farm	131.01	17/05	129.40
Bussels No. 7A	24.45	30/05	23.99
Alstonfield	197.02	15/05	186.08

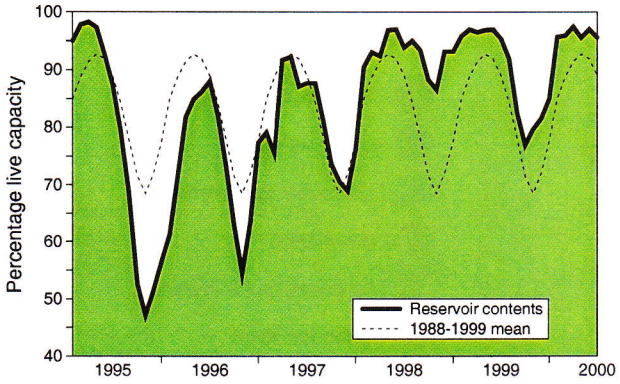
Levels in metres above Ordnance Datum



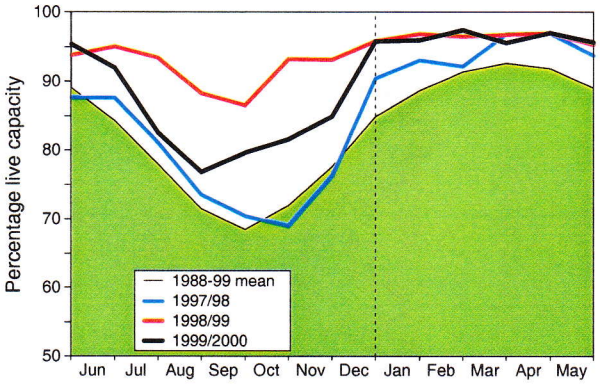
Groundwater levels - May 2000

The rankings are based on a comparison between the average level in the featured month (but often only single readings are available) and the average level in each corresponding month on record. They need to be interpreted with caution especially when groundwater levels are changing rapidly or when comparing wells with very different periods of record. Rankings may be omitted where they are considered misleading.

Guide to the variation in overall reservoir stocks for England and Wales



Comparison between overall reservoir stocks for England and Wales in recent years



These plots are based on the England and Wales figures listed below.

Percentage live capacity of selected reservoirs

Area	Reservoir	Capacity (Ml)	2000 Jan	Feb	Mar	Apr	May	**Jun**	Min. Jun	Year* of min
North West	N Command Zone	• 133375	93	98	100	92	88	79	72	1991
	Vyrnwy	55146	99	96	96	95	99	95	72	1990
Northumbrian	Teesdale	• 87936	99	97	100	94	100	100	64	1991
	Kielder	(199175)	(100)	(93)	(97)	(90)	(94)	(95)	(85)	1989
Severn Trent	Clywedog	44922	91	88	94	93	99	99	83	1989
	Derwent Valley	• 39525	100	100	100	100	100	100	56	1996
Yorkshire	Washburn	• 22035	99	98	100	94	100	99	72	1990
	Bradford supply	• 41407	99	99	99	93	99	92	70	1996
Anglian	Grafham	** (55490)	(95)	(94)	(90)	(94)	(96)	(91)	(72)	1997
	Rutland	**(116580)	(88)	(91)	(94)	(95)	(97)	(96)	(75)	1997
Thames	London	• 206399	94	95	95	96	97	96	83	1990
	Farmoor	• 13843	77	95	93	88	81	97	96	1999
Southern	Bewl	28170	74	95	98	98	100	100	57	1990
	Ardingly	4685	100	100	100	100	100	100	96	1990
Wessex	Clatworthy	5364	100	98	100	98	100	98	67	1990
	Bristol WW	• (38666)	(93)	(94)	(96)	(95)	(98)	(99)	(70)	1990
South West	Colliford	28540	96	98	100	100	100	100	52	1997
	Roadford	34500	99	95	100	97	99	97	48	1996
	Wimbleball	21320	100	100	100	100	100	100	76	1992
	Stithians	5205	94	98	100	98	98	92	66	1990
Welsh	Celyn and Brenig	• 131155	99	99	100	100	100	100	82	1996
	Brianne	62140	100	98	100	97	100	100	85	1995
	Big Five	• 69762	94	98	97	96	98	98	70	1990
	Elan Valley	• 99106	100	100	100	100	100	99	85	1990
East of Scotland	Edinburgh/Mid Lothian	• 97639	100	98	99	99	100	95	52	1998
	East Lothian	• 10206	99	97	100	97	100	99	84	1990
West of Scotland	Loch Katrine	• 111363	88	85	95	88	84	69	69	2000
	Daer	22412	100	100	100	97	97	90	70	1994
	Loch Thom	• 11840	100	100	100	97	92	79	79	2000
Northern Ireland	Silent Valley	• 20634	61	62	63	57	58	56	56	2000

()figures in parentheses relate to gross storage • denotes reservoir groups *last occurrence **updated gross capacity

Details of the individual reservoirs in each of the groupings listed above are available on request. The featured reservoirs may not be representative of the storage conditions across each region; this can be particularly important during droughts. The minimum storage figures relate to the 1988-2000 period only (except for West of Scotland where data commence in 1994). In some gravity-fed reservoirs (e.g. Clywedog) stocks are kept below capacity during the winter to provide scope for flood attenuation purposes.

Location map . . . Location map

National Hydrological Monitoring Programme

The National Hydrological Monitoring Programme was instigated in 1988 and is undertaken jointly by the Centre for Ecology and Hydrology, Wallingford (formerly the Institute of Hydrology - IH) and the British Geological Survey (BGS). Financial support for the production of the monthly Hydrological Summaries is provided by the Department of the Environment, Transport and the Regions, the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA), the Rivers Agency (RA) in Northern Ireland, and the Office of Water Services (OFWAT).

Data Sources

River flow and groundwater level data are provided by the regional divisions of the EA (England and Wales) and SEPA (Scotland), data for Northern Ireland are provided by the Rivers Agency and the Department of the Environment (NI). In all cases the data are subject to revision following validation (flood and drought data in particular may be subject to significant revision).

Reservoir level information is provided by the Water Service Companies, the EA, the West of Scotland and East of Scotland Water Authorities, and the Northern Ireland Water Service.

The National River Flow Archive (maintained by CEH Wallingford) and the National Groundwater Level Archive (maintained by BGS) provide the historical perspective within which to examine contemporary hydrological conditions.

Rainfall

Most rainfall data are provided by The Met. Office (address opposite). To allow better spatial differentiation the rainfall data for Britain are presented for the regional divisions of the precursor organisations of the EA and SEPA. Since the discontinuation of The Met. Office's CARP system in July 1998, rainfall figures have been provided by differing methods. Initial rainfall estimates for Scotland and the Scottish regions were derived by IH in collaboration with SEPA. In England and Wales, between July 1998 and May 1999, provisional rainfall figures derive from MORECS*. Beginning with the June 1999 report, provisional rainfall figures for England and Wales, the EA regions and Northern Ireland (from September 1999) have been produced by The Met. Office, National Climate Information Centre (NCIC), using a technique similar to CARP. An initiative is underway with The Met. Office to provide more accurate areal figures and, since October 1999, to include more raingauges in the analysis. A significant number of additional monthly rainfall totals are currently being provided by SEPA; over the coming months further monthly raingauge totals will be included for selected EA regions. Until the access to these additional data has stabilised the regional figures (and the return periods associated with them) should be regarded as a guide only.

*MORECS is the generic name for the Meteorological Office services involving the routine calculation of evaporation and soil moisture throughout Great Britain.

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The cooperation of all data suppliers is gratefully acknowledged.

Subscription

Subscription to the Hydrological Summaries costs £48 per year. Orders should be addressed to:

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